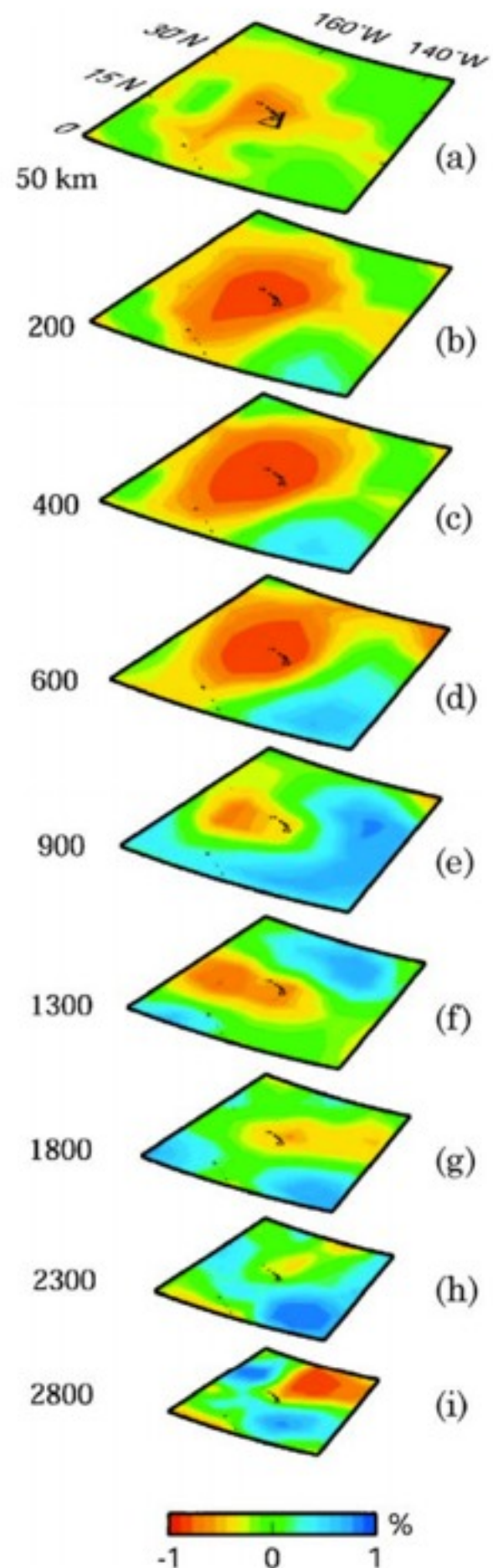


eRHIC as a Nucleon Tomograph

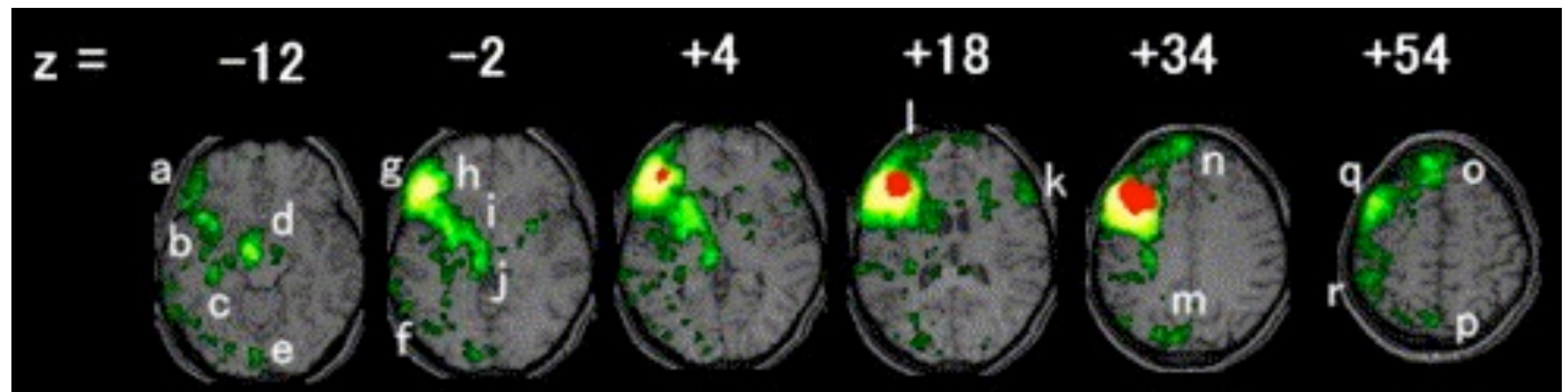
Thomas Burton
DNP Fall Meeting
Newport Beach CA
Saturday 27th October 2012

Tomography

J. Lei, D. Zhao, Earth and Planetary Science Letters **241**, 438–453 (2006).



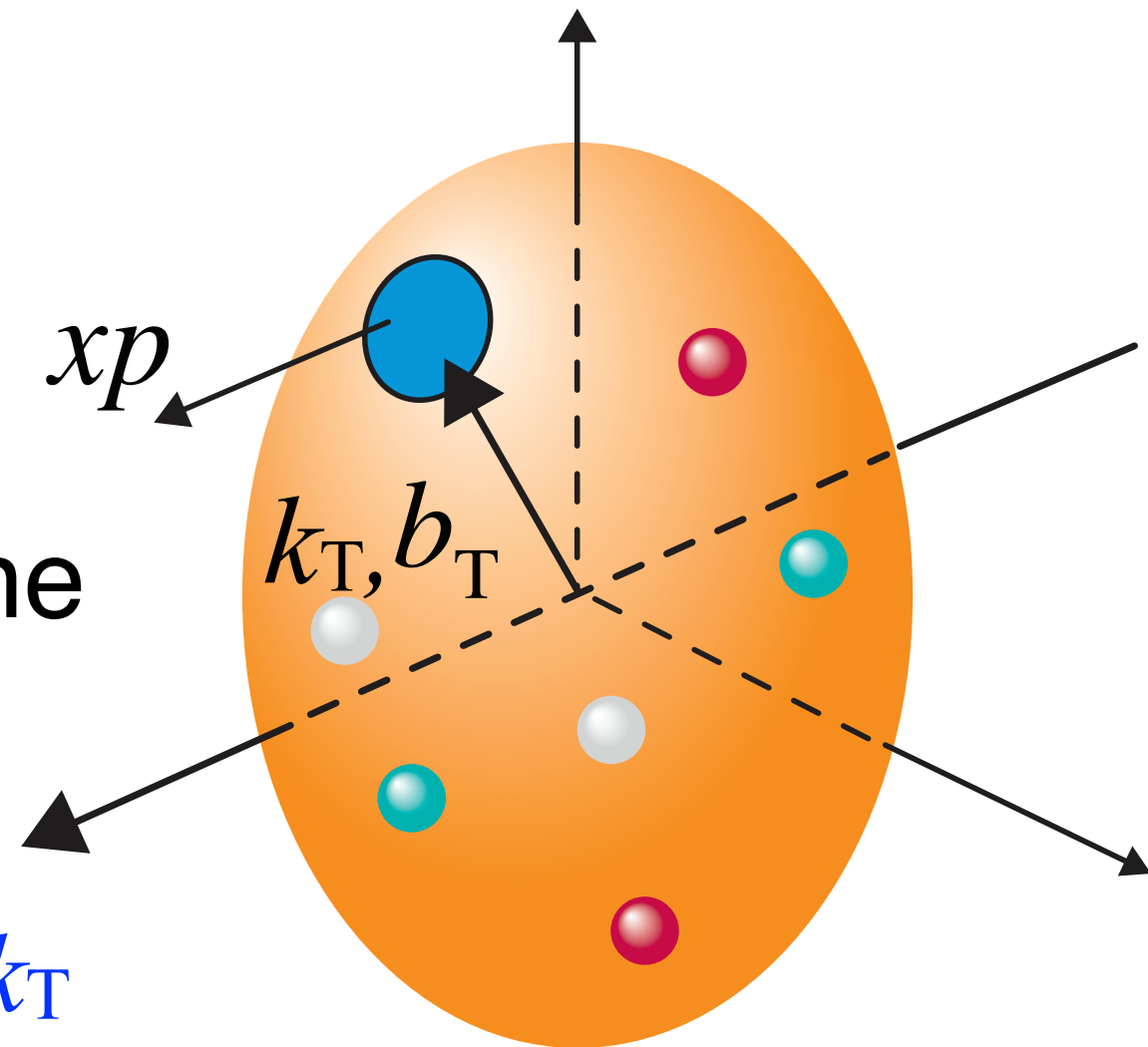
E. Takahashi, K. Ohki, D-S. Kim, NeuroImage **34**, 827-838 (2007).



- **Imaging in 2D slices**
- Tomographic techniques in many fields: medicine, oceanography, seismology...
- Want to do the same for **nucleons**
 - ▶ How to “image” on scales of 10^{-15} fm?

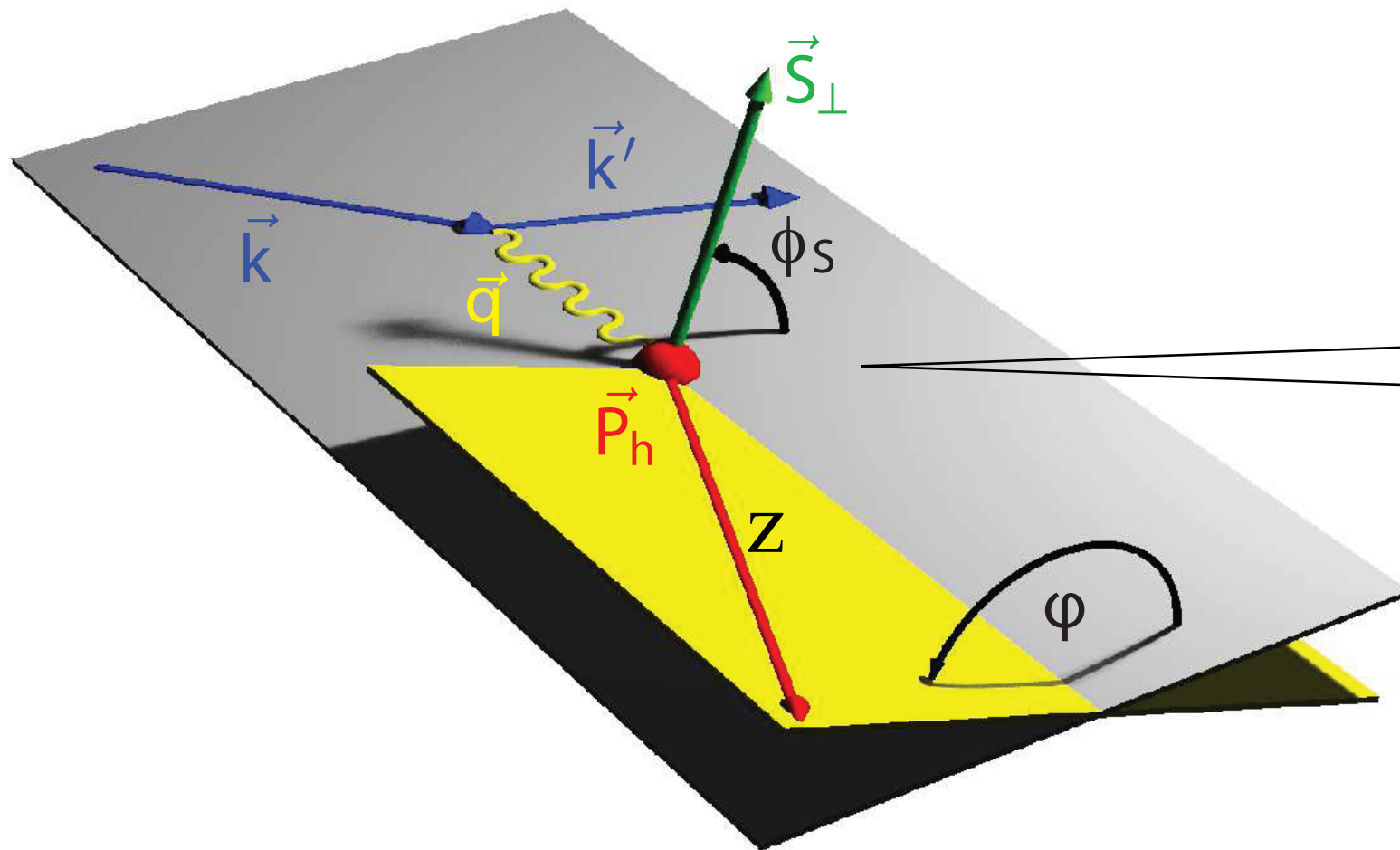
Nucleon Tomography

- 2D image in transverse plane
- Two **types**, two **tools**:
 1. Transverse **momentum**, k_T
Semi-inclusive measurements
 2. Transverse **position**, b_T
Exclusive measurements



1) Transverse momentum

SIDIS

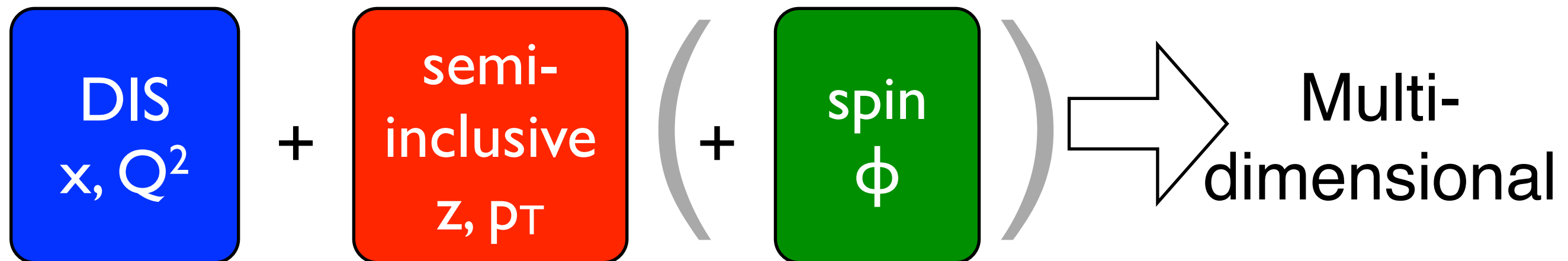


Semi-Inclusive Deeply Inelastic Scattering

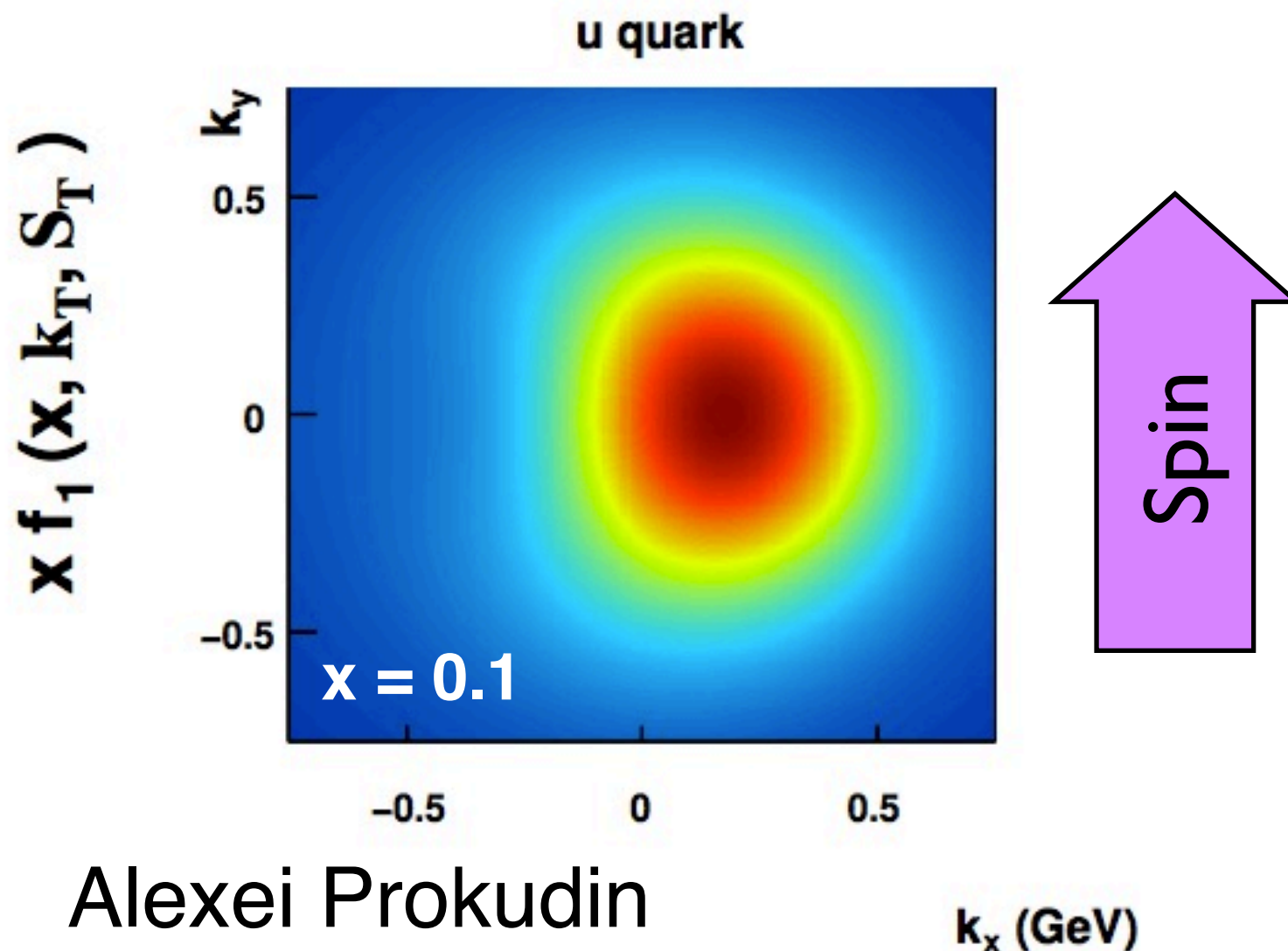
Measure the
electron + a
single hadron



characterised via
(z, p_T)



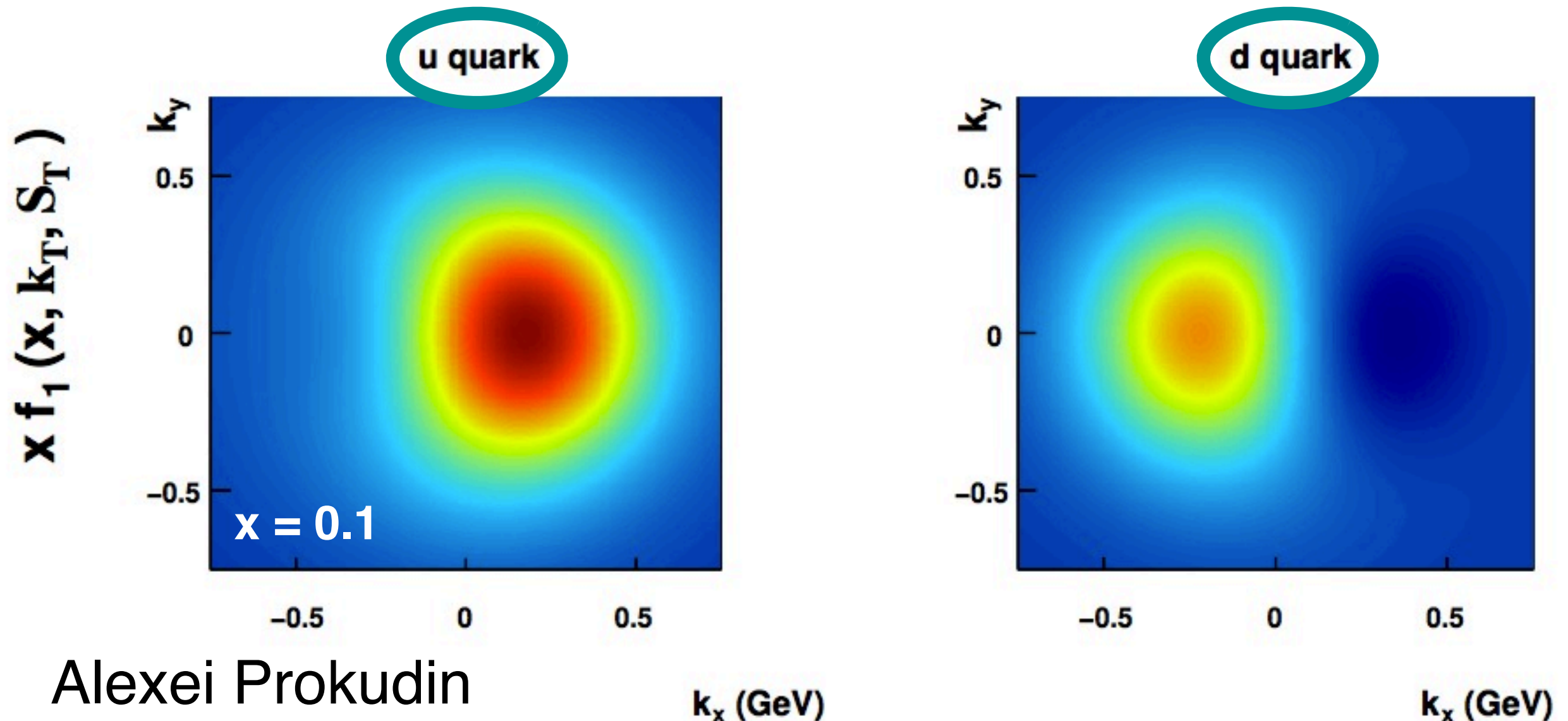
- Gives additional hadron information
 - ▶ extract “*transverse-momentum-dependent distributions*”: **TMDs**



1) Spin-dependence:
see deformation of
parton distribution
e.g. **Sivers** function

Alexei Prokudin

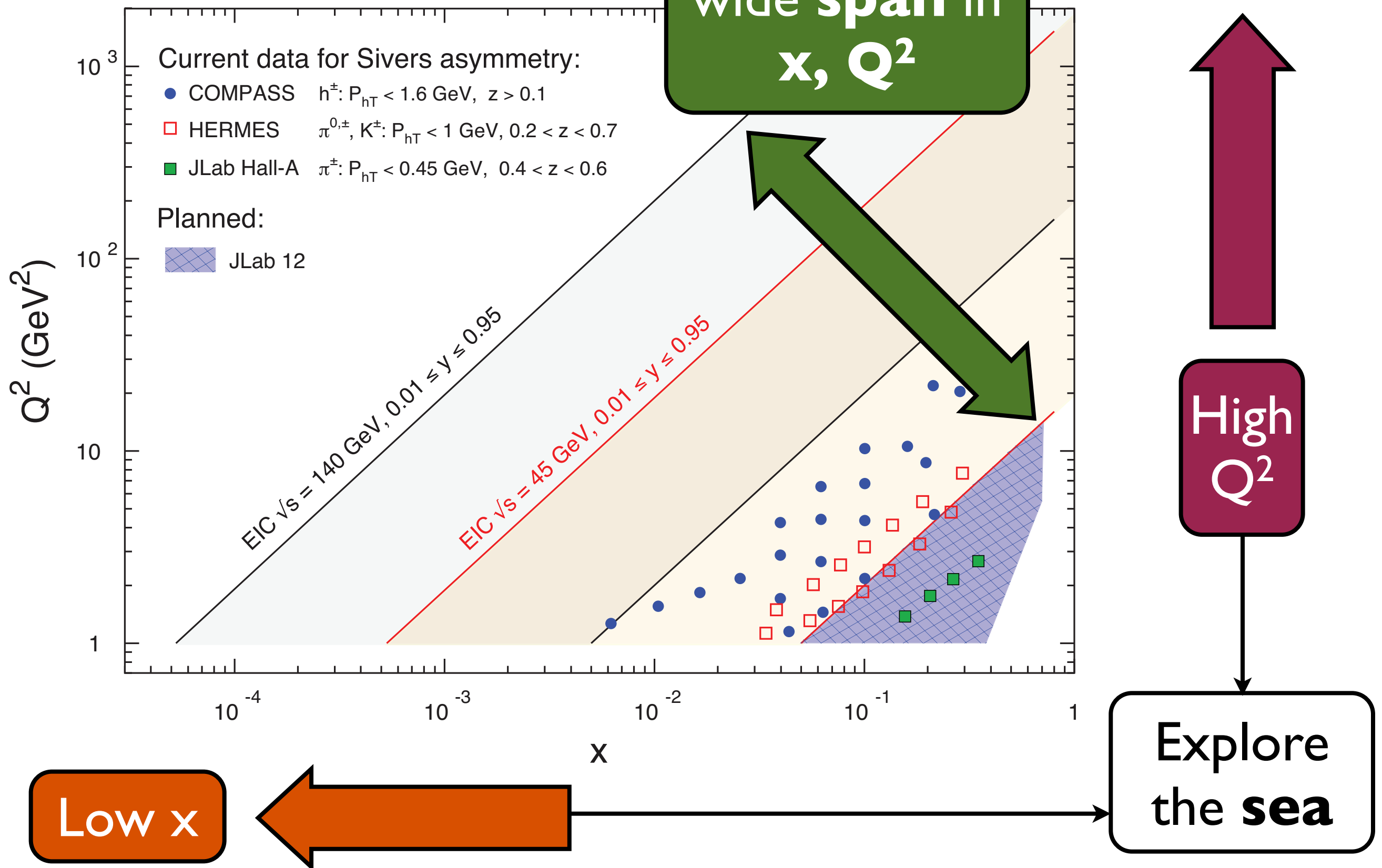
- Gives additional hadron information
 - extract “*transverse-momentum-dependent distributions*”: **TMDs**



Alexei Prokudin

2) Identify hadrons: decompose **flavour** dependence

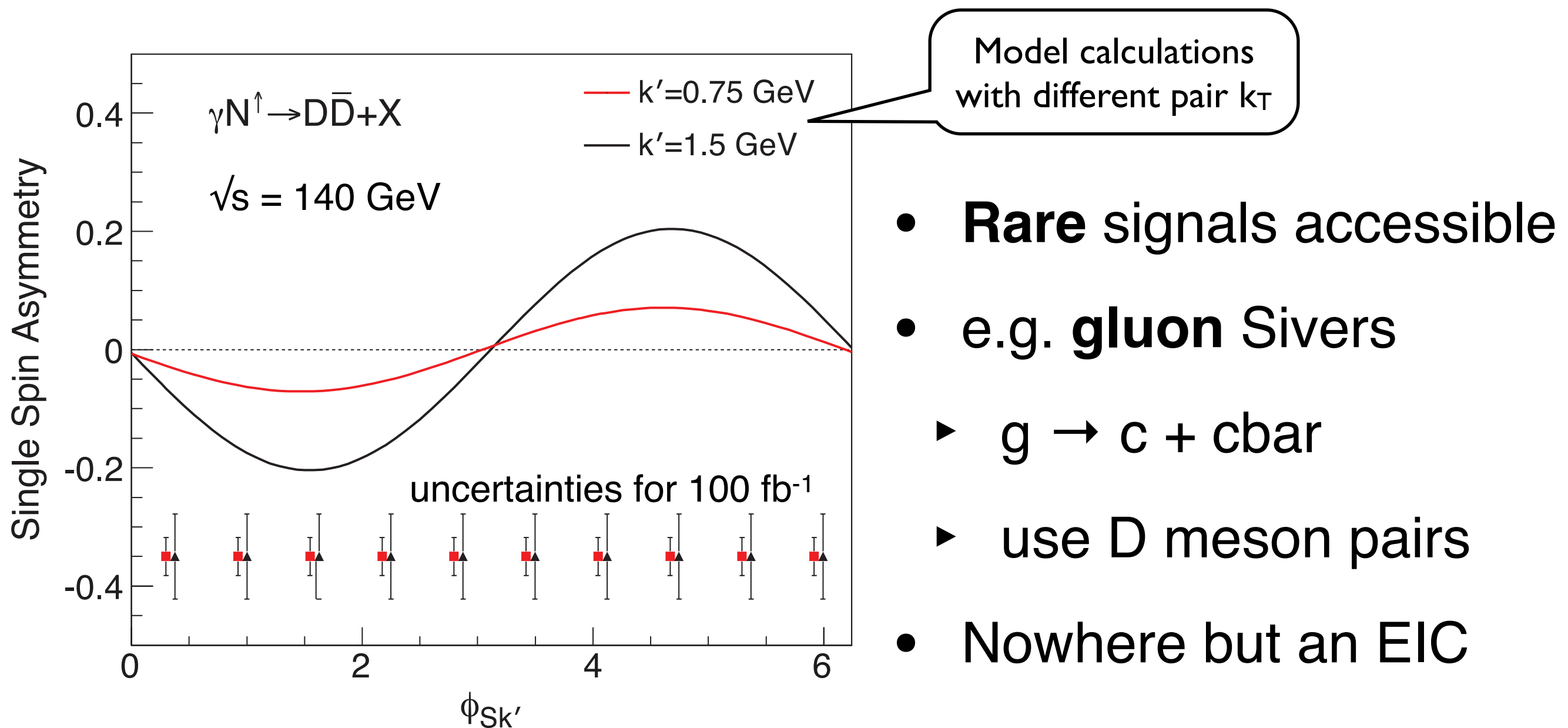
Kinematics



Luminosity

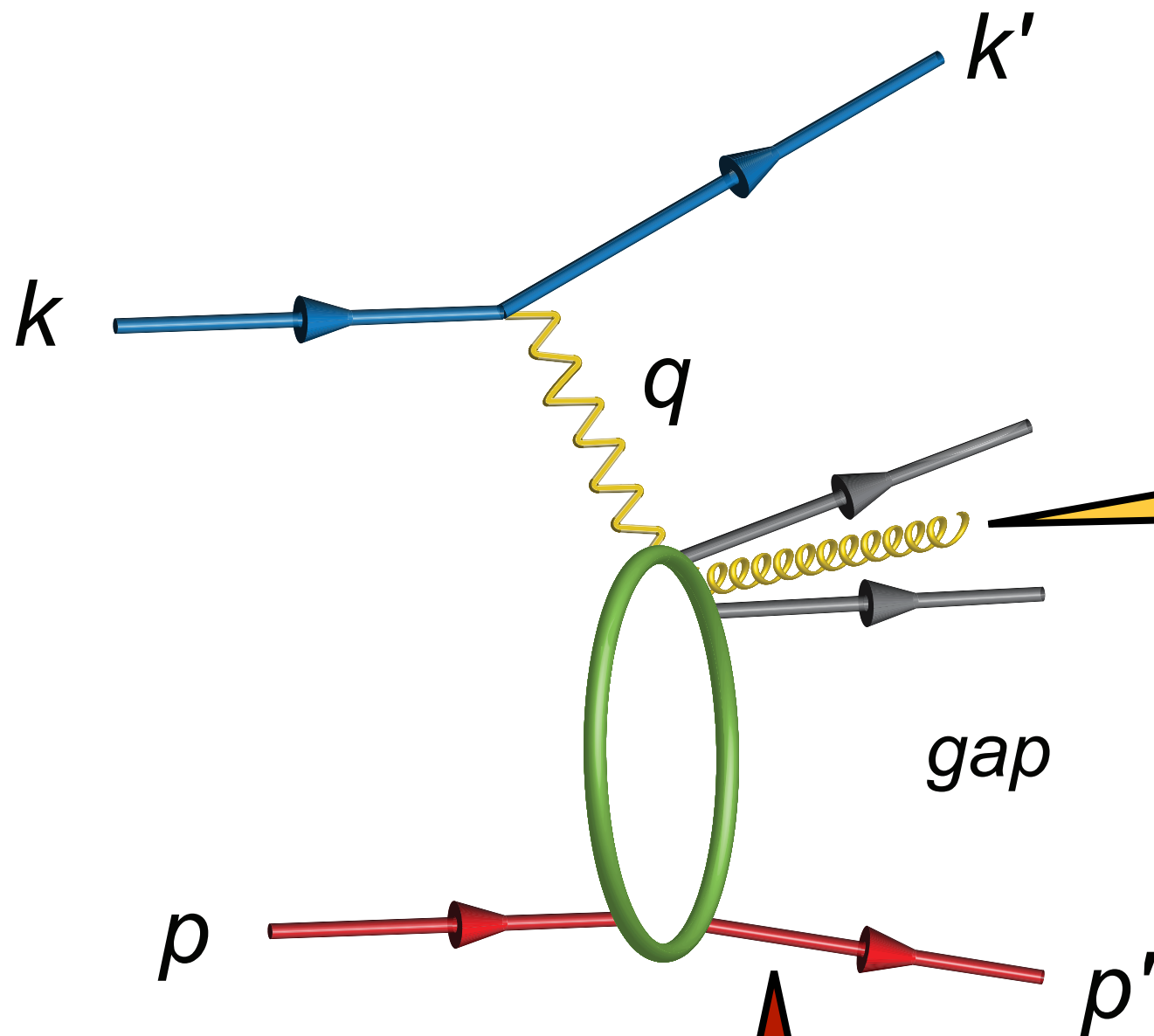
$10^{34} \text{ cm}^{-2}\text{s}^{-1}$: 100s times HERA

- Measurements with π , K **very precise**
 - mostly **systematics**-dominated



2) Transverse position

Exclusive production



Exclusive reaction:
produces a **single**
boson: γ , J/ψ , ϕ ...

4-momentum
transfer to
proton: t

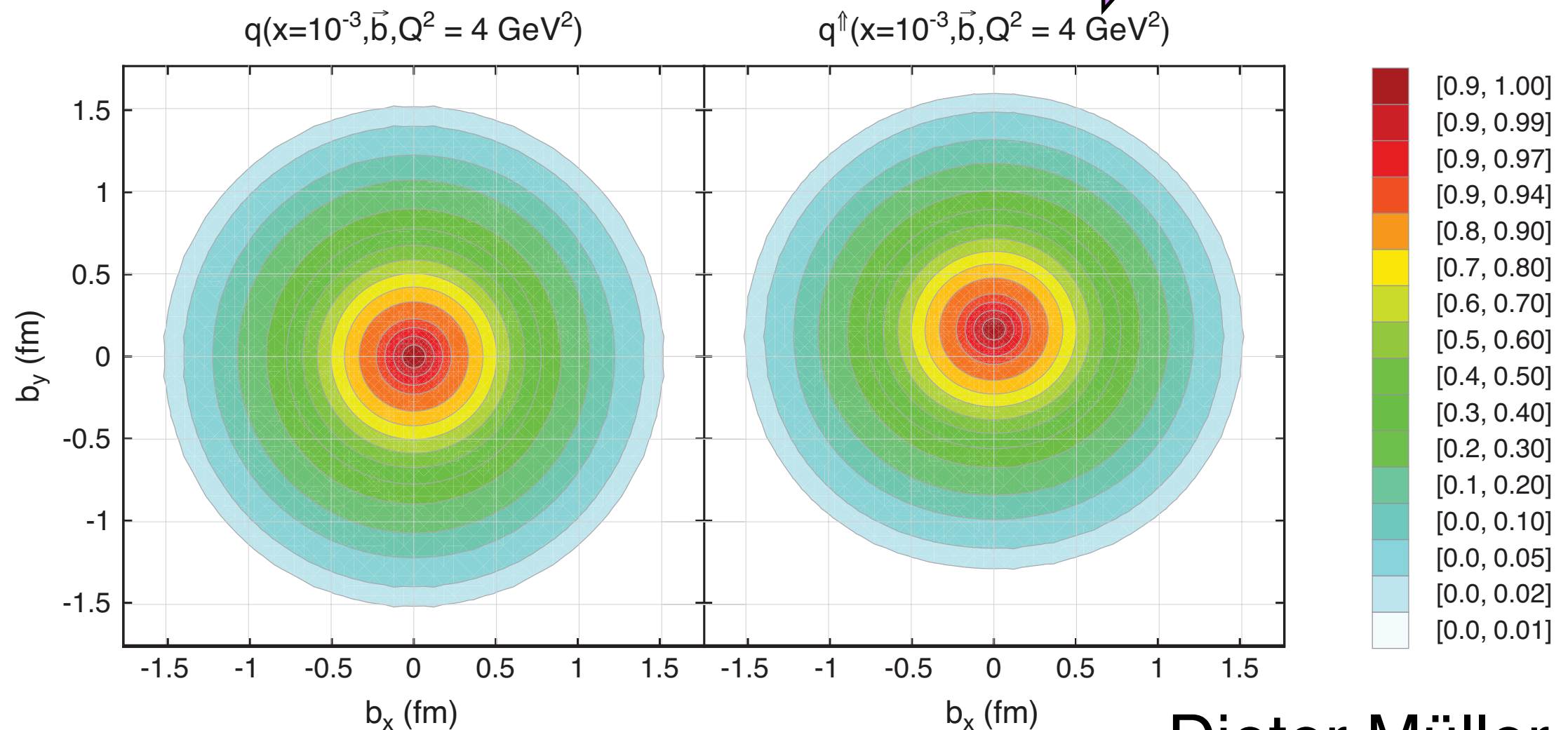
Provides access to
“*generalised parton
distributions*”, GPDs

b dependence

- **Fourier transform of $d\sigma/dt$:**

- ▶ **b** dependence
- ▶ **2D spatial picture**

Spin → Investigate effect of spin



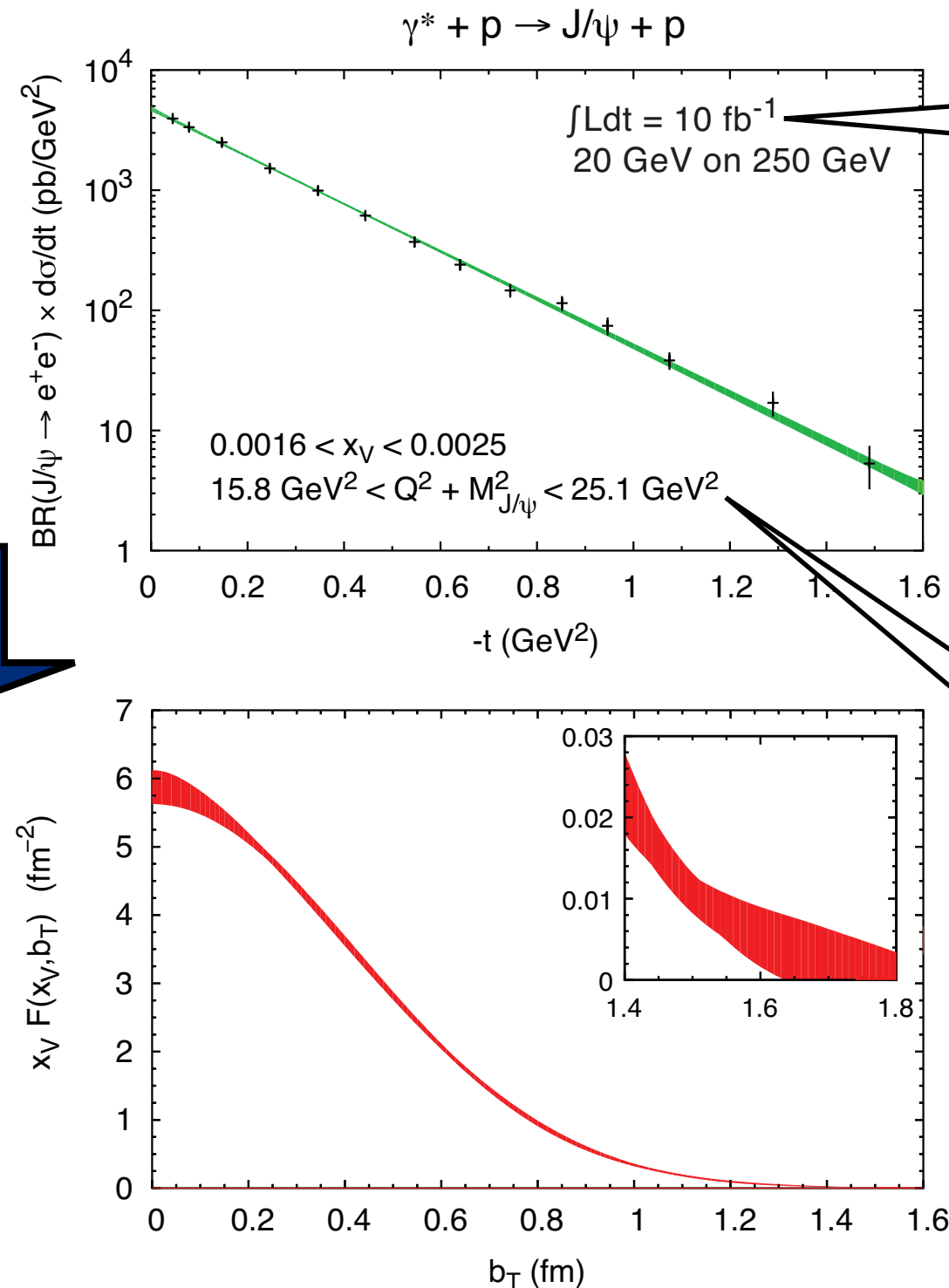
Dieter Müller

J/psi production

t

**Fourier
transform**

b

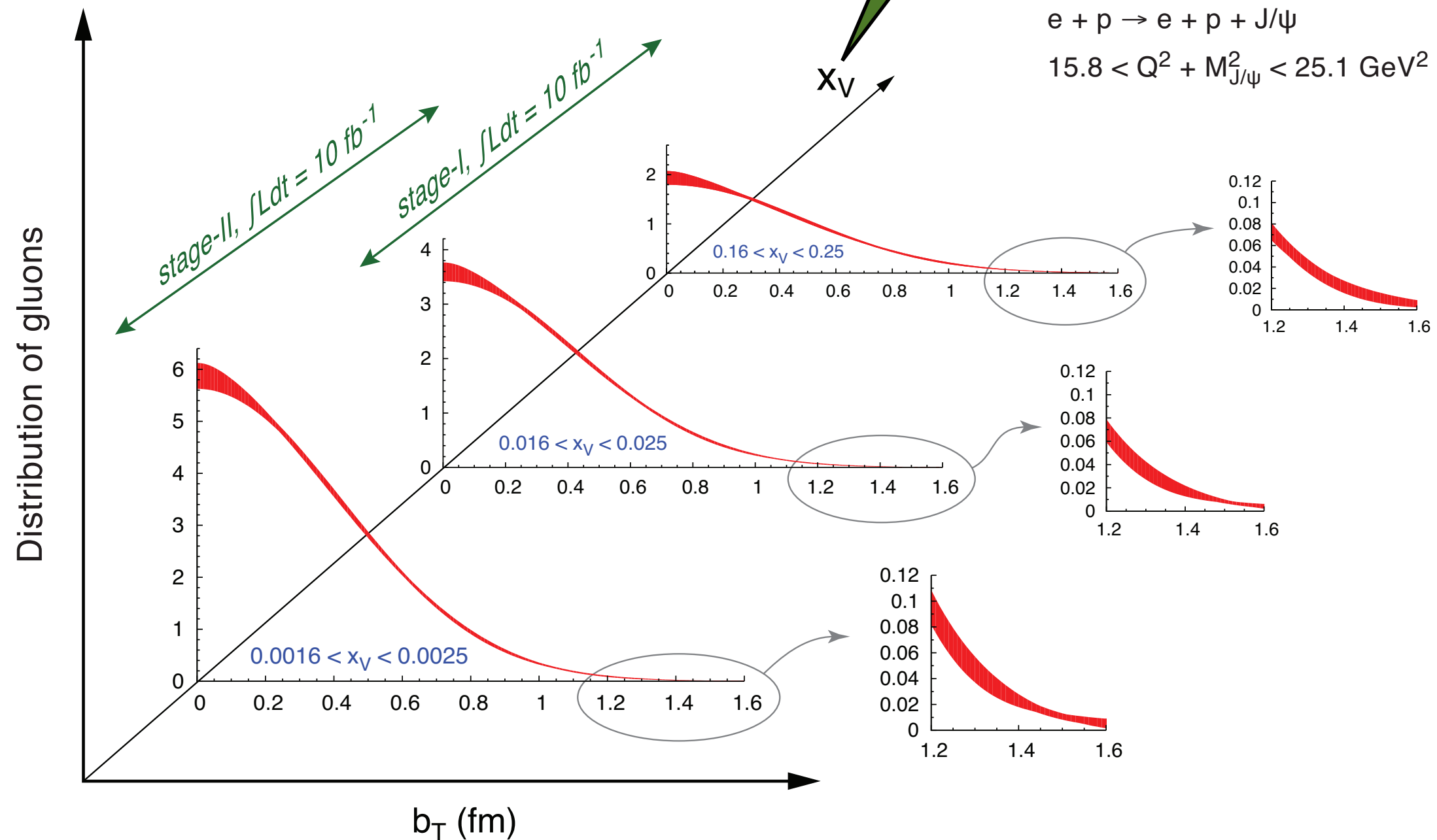


**Tiny statistical
errors in < 1
year running**

**Fine binning in
(x, Q^2, t)**

J/psi production

b-dependence “slices”
through x space



Overview

- TBA